

THE APPLICATION OF SANITARY SCIENCE TO THE GREAT WAR IN THE ZONE OF THE ARMY.¹

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It may be somewhat of a disappointment that I should present so little that is new to this Society, but war has requisitioned of science its application and not its theories and each man has been called upon to produce a result. The interest in this subject lies in seeing how far sanitary science could be applied on the battlefield and what part it took in winning this war. Let us answer the last question first:

In the Civil War there were 65 deaths from disease annually per 1,000 of strength; in the Spanish-American War there were 30; in the Greatest of Wars just concluded there were 14.8 and of these about 12 were due to epidemic pneumonia. That is to say, the medical sciences have kept 100,000 American men in fighting trim who would have in 1861 died of disease, and America needed those men. There was no time to get trained men from home, nor vessels in which to send them; the expense per man, the least consideration, was enormous, and, above all, if the liberty of the world was to be won at all it had to be done by the brawn of these very men and like men of our Allies. It had to be done *then*. The hour had struck. All the treasure and patriotic devotion of our country was helpless to do more in this crisis. When one reflects that never have armies been forced to live under more menacing conditions to health than those under which our soldiers lived and fought—at times, for military reasons, with reduced rations and much of the time underground, one cannot but wonder how it is that our generous people do not yield more than a passing thought to the scientist and to the science that made his invisible weapons. And the prevention of dis-

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ease was only one of the activities of our medical sciences against the German. The part played by surgery, by medicine itself and by the skilful evacuation of wounded has yet to be written. We are apt to confuse our priestly mission of ministering to the suffering of friend and foe alike, with that militant one of applying our mind and body, our art and science, to win the war. A man who carries arms is not less a soldier for observing the laws of humanity in his treatment of a fallen enemy. A doctor who keeps healthy men at the front and salvages the sick and wounded to fight again is no less a soldier because he carries no rifle.

We went into this war with one officer per 27,000 men, one man in the division, charged *exclusively* with the responsibilities of the sanitation of our great fighting unit. He was only an advisory officer by law. He was a high ranking officer because rank is the current coin in the Army, and rank has its privileges. But he had strong support because he represented a reasonable and powerful science. Most commanders, jealous of the health of their troops, gave him every possible chance to work out his salvation. Some even gave him authority to command in their name. But the weak point lay in his lack of a force of trained men of his own to carry out his own suggestions. It was too much to require of fighting troops that they should lay aside their arms, often after exhaustive physical strain in the line, to build privies, delousers, etc. It was their duty to do their part but not all the creative work.

Again, this officer was expected to transform a new area into which the division would be suddenly thrust, into a sanitarily safe living-place for these soldiers and to do it right away. It was only when he failed to do it that he realized the full prominence of his position, for he was charged with the responsibility to his military chief for failure. This sudden assumption of responsibility for the sanitation of an unprepared area, or an area soiled by preceding troops, was another weak point. It is true that all medical officers of whatever condition are charged by law with sustaining the sanitary excellence of the command to which they are assigned, but "in addition to their other duties," and these other duties become in active periods paramount. In practice every one tried to keep things

sanitary, but only one, the division sanitary inspector, had nothing else to do and all he could *do* was request and advise.

But the Great War promptly threw the spotlight on these weak points and to its everlasting credit the Army began to evolve a plan to remedy them most skilfully. First, labor battalions began to be employed to prepare areas for troop cantonment, as well as to "clean up" after a battle. Two sanitary squads of one officer and 26 men were assigned exclusively to certain divisions for sanitary duty. These men were plumbers, pipe-fitters, carpenters, masons, tinsmiths and artisans of all sorts needed for carrying into effect sanitary plans. Engineer troops, quartermaster troops and even, when necessary, soldiers of the line, were to be called upon to help in work clearly beyond the scope and endurance of these two squads. But of all the promising steps taken in these reforms the plan of providing a permanent sanitary organization for Army areas was the best. Instead of a confused and hurried attempt every time a division was moved, to sanitize its new area by its own efforts at enormous expense, such efforts to be repeated more or less by the next division when in a week or so the first moved on, the Army, through its chief sanitary inspector, was to divide up its area into three sections, each of which was to be divided into from 8 to 12 subsections. These sections were plotted out for topographical reasons, and with an eye to highways, and had no reference to the divisions which might occupy them. The personnel was permanent and did not leave when divisions occupying their section left. They were Army units, under the military zone commander. They prepared the sanitary appliances for the incoming troops and helped keep them in repair as well as keeping a watchful eye over them. They exercised no authority over the troops using them,—they were there to help the troops keep decent and comfortable, as well as to prevent disease. The reason why they were Army units is that an Army is the least mobile unit in regard to its area. The divisions and corps were constantly changing. Each section had its chief in a town where he was to run a small school of sanitation and was to have a sanitary squad to build sanitary appliances for demonstration as well as to aid in repairing them in the sections which were being actually used. The sanitary squad at Langres was early stationed at the dump and from

its culls recovered enough lumber, metal, etc., to build 101 flyproof latrines, 67 urinals, 23 grease traps and 16 incinerators *in a month*. This was due to their commanding officer, Captain Starr A. Moulton, and shows how 1 officer and 24 men can provide a whole area occupied by the equivalent of a division with sanitary appliances and sanitize an area out of nothing, remaining on good terms with everybody.

The sanitary section of an Army area should be traversible in all directions by automobile and is thus constantly under the eye of the young sanitary officer.

The subsection is manned by a non-commissioned officer and two or three men, responsible to the section chief. They are his eyes—they give no orders, but are distinguished by an armlet and know everything that goes on in every nook and cranny of their territory, traversible on foot or horseback. They make themselves popular with shifting battalions who are only too glad of a helping hand and they keep the sanitary section chief thoroughly in touch with his problems.

The man who will make area sanitation a success must be a man who lives permanently in that area and who has this and nothing else to think of; who has planned and built its appliances; who will fight for them; who will enthuse the men personally in their proper use; stimulate competition; prevent waste; prevent heady unit commanders from blocking proper sanitary functions in his section; who will make himself a helpful and not a carping critic; who has a remedy and can do things as well as talk; who is not unreasonable but just a normal, sane, well-bred, well-educated gentleman with a keen sense of humor and an indomitable will; with his mental processes backed by scientific facts, his actions by common sense. In short, a man with enough of the prose of material results and the poetry of an invincible spirit to make a plan succeed, even if that plan is not a perfect one.

That is the sort of a man we want.

This leaves the division sanitary inspector with his two squads free to run the machine and not to make and run it at one and the same time. He administers the area and if he is at the front he has some time to devote to his legitimate duty, that of providing trench

sanitation, or the sanitation of an open battlefield, as the case might be. He has a divisional water-supply officer on his staff. He keeps a close watch on diseases which might become epidemic in his command and in epidemics works in coöperation with the chief sanitary officer of the Army. He is in close touch with Army laboratories and calls on them for special work.

EPIDEMIOLOGY.

The classification of communicable diseases and the administration of the epidemiologic service is based on an exposition of this subject made before the Army Sanitary School in Langres by Colonel Hans Zinnser, chief sanitary officer of the Second Army. This officer was working out these plans when the war came to a close and to him we are indebted for a prominent part in a great reform.

The Army chief sanitary officer should be an epidemiologist and laboratory man, as well as an administrator. He should keep spot maps showing the prevalence and source of infectious disease. In this he is largely dependent upon his section chiefs and divisional sanitary officers. He should have a stationary laboratory capable of becoming mobile at headquarters of the field Army, with two traveling motorized laboratories to dispatch to special work. I am not in accord with Colonel Zinnser in depriving a division of its mobile laboratory, but these two motor laboratories can be kept busy reinforcing division laboratories and checking their work. Infectious diseases are roughly divided into, (1) those disseminated by the respiratory tract: Pneumonia, influenza, measles, scarlet fever, meningitis, mumps, smallpox and chickenpox. (2) Those disseminated by the intestinal tract: Typhoid and its congeners, the dysenteries, simple diarrhea, etc. (3) Insect-borne diseases: trench fever, typhus, malaria, scabies, etc.

Communicable diseases depend for their extension either on the susceptibility of the individual or upon means and methods of transmission. For the first, such as meningitis and pneumonia, general hygienic measures were enforced with a degree of insistence and elaborateness of detail dependent upon the circumstances and serious-

ness of the local problem. The general measures employed to limit the spread of diseases disseminated by the respiratory system are:

1. *Hygiene of Living Quarters*: (a) A minimum of 40 square feet per man. If less, the suspension of shelter halves between bunks. (b) Head and foot sleeping in bunks side by side. (c) The spread of a command in tents in warm weather. (d) Ventilation by perflation once a day and once at night between taps and reveille. (e) Airing of blankets and bedding several hours on propitious days. (f) The invariable punishment of promiscuous spitting. (g) The sweeping of floors once a day after sprinkling.

2. *Hygiene of Mess Kits*: (a) Immersion after use in boiling water. Men were lined up after meals and made to dip their eating utensils in a ten-gallon, or larger, container of boiling soapsuds kept at ebullition by a hot fire. (b) Rinsing of same in flowing water. (c) Air-drying of same. No common towels permitted.

3. *Inspections of Command*: (a) Men lined up and inspected twice a day for head colds, cough and inflamed eyes. (b) Temperature taking of men not feeling well. (c) Segregations of all coughs, colds and red eyes in a separate barracks or curtained-off portion of a common barrack. (d) Evacuation of all with fever to a hospital.

4. *Inspection of Men's Personal Equipment*: The verification of possession by each man of a raincoat, an overcoat, two pairs of shoes, three blankets and three pairs of socks.

5. *Provision for a Drying Room for Clothing*—a vital necessity in France.

6. *Avoidance of Excessive Labor*. Drills and fatigue duty should be cut to a minimum to avoid exhaustion, fatigue being a well-known condition of inviting infection by lowering individual resistance.

The majority of these measures could only be enforced in rest areas. In combat, naturally, no sensible man could consider the employment of more than a tithe of these protective measures.

The general measures employed to prevent dissemination of diseases by the intestinal tract are:

1. *Care of Latrines*:

(a) Fly-proofing (area sanitation).

(b) Disinfection of interior of receptacles and latrine seats during an epidemic (divisional sanitary squads).

(c) Ablution benches or other provision for handwashing after use of latrines (area sanitation).

(d) Prohibition of towels.

2. *Sanitation of Kitchens:*

(a) Neatness and cleanliness of kitchen itself and utensils.

(b) Prohibition against use of uncooked food.

(c) Enforced hand cleanliness of kitchen crew.

(d) Medical inspection of kitchen personnel and all handlers of food and removal of all sick or sickening, as well as carriers.

3. *Surveillance of Drinking Water:*

(a) Proper chlorinization of water and a bacteriological examination of disinfected water from time to time as a check thereon. (Division sanitary squads and Army mobile laboratory.)

(b) Careful supervision of water sources and guard therefor (unit commander, division sanitary inspector, sanitary section chief, engineer water supply details, Army mobile laboratory).

(c) Supervision over water carts (division sanitary personnel).

4. *Disposal of Garbage and Offal:*

(a) Soakage pits for liquid waste.

(b) Incineration, or sale, or other, disposal to civilians of solid garbage.

(c) Prompt burial of carcasses.

(d) Removal and proper disposition of manure (burning was impossible).

5. *Prompt Notification of Military Chief when in the Presence of Epidemic Conditions.*

It will not be amiss to consider briefly the *Special Procedures* for *Special Diseases*.

Typhus and trench fever require careful destruction of lice, the carriers of these diseases.

Typhoid and *congeners* were practically eliminated from all Armies by vaccination. The few persons who acquired typhoid fever were especially susceptible and did not receive a large enough preventive dose of the vaccine; were recipients of an overwhelming

dose of virulent organisms, or, through carelessness, were not properly inoculated.

Influenza demanded prompt evacuation in separate ambulances, segregation, and masking.

Smallpox called for strict quarantine and vaccination.

Trench foot: Issuance of dry socks at dinnertime, when in the line, or in very muddy terrain elsewhere; powdering of feet with a combination of camphor, salicylic acid and talcum; mutual massage of feet, after removing shoes, in groups of two when in the line; precluding of foot and leg covering which constricts the circulation; drying of shoes at every favorable opportunity.

Venereal disease: Propaganda, prophylactic stations and surveillance of civilians. Applicable in cantonments.

Tetanus: Universal prevention dose of antitoxin in all wounds and in trench foot.

Boils and other infective inflammations of the deeper layers of the skin: Inspection of men at baths for scabies and other sources of irritation of the skin, and segregation under treatment. These skin affections, plus lousiness which often caused trench fever, were responsible, it is said, for a full 90 per cent. of all incapacitation from disease in a British Army.

It is extremely interesting to review the experience of the French and British during the long months of war preceding our entrance into these scenes, a time when experience, that bitter teacher, was elaborating for us the saving knowledge that Briton and Gaul turned over to us for our protection, without a thought inspired by selfish pride, or the slightest attempt to cloak their own shortcomings, that by these truths our men should live to fight.

When the war broke upon Europe, France, we were told, had no compulsory vaccination against typhoid. The result was that for the first six months, due, in part, to a life-and-death struggle in which only military resistance could be considered, typhoid ran rampant. No one knows how many cases developed in the French Army; one French officer named a figure that is so high as to be almost incredible. Compulsory vaccination wiped out the disease from this Army in the succeeding months. In the British Army 90 per cent. of her men were inoculated against this disease with the

result that there were only 7,700 cases of a strength of 2,000,000, throughout a period of 40 months of campaigns. Compare this with their record in the South African War when, of a force of 100,000 men, and very few vaccinations, there were 56,000 cases and 8,000 deaths, and with the record of the first American Army of one million men, which according to its Chief Surgeon, Colonel Alex. Stark, had only 17 *cases* of typhoid and 10 of para-typhoid to January 1, 1919. With tetanus in 1914 there were 32 cases per 1,000 wounded; in 1917, a small fraction of 1 per cent., the favorable change being due to strict orders that all wounded should be given a preventive dose of the antitoxin.

In the first British Army in 1915-16, 3,311 cases of trench foot were evacuated; in 1916-17, only 395. In the fourth French Army in 1916-17, 2,861 were treated for trench foot. As a result of the clear enunciation, in time, of the preventive measures to be taken, practically no cases developed in the American Army.

Availing ourselves of their knowledge, plus the proof by Strong, of our Army, on suggestive evidence presented by the British that trench fever was carried by lice, plus the experience of both French and British that the destruction of insect life in clothing would enormously reduce morbidity, the American Army, with its own enlightened medical corps, reinforced by the frank testimony of the Allied troops, was able to produce a record for preventive medicine in war the like of which the world has never before seen.

All of these precautions above noted being in force and all of the special sanitary appliances for this war in function, there remains a general statement to be made: The chief cause of sick wastage, when sanitary science has already yielded its utmost, is reduced vitality from overwork, little sleep, poor food and constant cold. Many of these undesirable conditions are inseparable from certain military necessities, but it is an ill-conceived idea of a commanding officer that troops to be efficient should do arduous service and at the same time be deprived of possible comforts and prime necessities "in order to harden them," such as sleep. In such a war as the one through which we have just passed, this is not the time nor the place to weed out the men with slight imperfections capable of gradual remedy. The wise commanding officer will endeavor, where

the whole male fighting population of his nation is requisitioned for war, to keep all of his men and not only those who can rise above his own peculiar selective processes. It is vicious to get men up before sunrise, give them their breakfast in the dark and start them out in the cold morning mist, chilled, unfed and with clothing still damp from the rain of the day before to do a hard day's work, again terminating in wet and cold. It is still worse to gather such men after supper with clothes still wet for lectures running far into the night. This "intensive training" may break down a man before he has the opportunity to deliver a blow, not only the palpably weak, but, to our surprise, the apparently strong. Our Field Regulations preach against this, our best officers of the old Army condemn it, and it is only mentioned to deter a well-meaning but inexperienced newcomer from a dangerous point of view. The best officer knows how to care for and feed his men and the best troops are faithful witnesses of the effect of the care bestowed upon them.

THE SANITATION OF TRENCH WARFARE.

In the Trenches.

Sanitation is reduced to its simplest terms in the trenches. It has to be. Men are there to fight. In the brief week or ten days they are there before their relief, lights, smoke, evacuation, building, are taboo. Moreover every nerve is taut to get the best of the enemy and there is little time for things of immeasurably less importance, however simple and enticing the procedure may seem. Sanitary science is reduced to its barest necessities and then greatly reduced from that point.

Latrines: These are either buckets under a flyproof seat or fly-proof boxes over a pit in a blind offshoot from a communicating trench. There is a camouflaged head cover and there should be a can or trough leading to a soakage pit for urine. Pit latrines should be deep and buckets emptied in adjacent shell holes at night, as is garbage from food brought up to the men.

Water: This, in well consolidated positions, is pumped from a chlorinating source. It may be stored in cement water tanks or carried up from water carts in the rear. A trick of our soldiers was

to fill a large number of canteens in the rear, string them on a pole and thus carry them up. Water may be obtained from wells in dug-outs and, after filling the 40 gallon canvas Lyster bag, and disinfecting with hypochlorite powder, be doled out to the men. Best of all it may be piped up, but this could only be depended upon in very quiet sectors, as bombardment quickly broke down such a system.

Food: This is usually sent up once a day from kitchens in a communicating trench somewhere in the rear and is kept hot by storing food for 16 men in a marmite, or thermos can. There is a special danger in these cans, when the lid is left off until the temperature falls to blood heat and the lid then replaced, from fermentation, which may cause serious food poisoning.

Clothing: Dry socks should be supplied with the evening ration when men are standing in wet trenches. The necessity of standing in muddy water is the only excuse for the rubber boot, otherwise an abomination.

Drainage of trenches: Well-constructed trenches are floored with a duckboard path and under-drained by a gutter with occasional sumpholes which are emptied by suction pumps in favored positions.

Drying rooms: Every trench position of any permanence should provide these rooms, necessarily in a dug-out, and a brazier coke stove or two will be sufficient to accomplish satisfactory results.

Heating of dug-outs is by braziers. *Ventilation* by stove pipes with closing apparatus in case of a gas attack. *Light* by candles, kerosene lamps, acetylene or electricity, but oil lamps require oil to be brought up, a thing possible only in times of inactivity, acetylene is practically confined to medical dug-outs and electricity is only available in well-consolidated positions, long occupied.

The Sanitary Duties of the Battalion Medical Officer: The sacred relations established between this lone representative of our great profession and the soldier in his hour of trial is readily seen in the influence this officer wields for the prevention of disease. It is a personal relation. He talks to no audience and he indulges in no flights of fancy. A good battalion surgeon knows all the men; he is over in the trenches; he knows when the breaking strain has been reached in Jones and he laughs Smith out of his "shell-shock." He invents a thousand ways to make the men more comfortable,

supervises the simple sanitary arrangements of his sector and catches the first signs of a communicable disease in his command. The trench is no place to keep a sick man, but it takes a real doctor to determine whether he is sick, worn out or ailing. All communicable diseases are immediately evacuated if possible, but many an incipient "shell shock" or case of homesickness has been exorcised by a keen young medical officer in the trenches. One of his great duties is to "keep men on the line" and the man who aids in doing this has a friend in the battalion commander. There is no one for whom the men have greater respect, in whom they have greater faith, for whom they entertain a more loyal affection than "their doctor" unless it be their own personal commander, and this is as it should be. This picture has been attempted to show how strong a representation sanitary science has at the elbow of the fighting men and that it is this human touch, humanely administered, that makes the practice of hygiene possible among our troops. The most that we ask, that we require, of our men *under fire* is to be as clean as possible and decent always.

THE SANITATION OF OPEN WARFARE.

Here sanitation is reduced to a mere shred, but the little that can be done often makes the difference between ultimate victory or defeat.

The essentials are:

1. Hot food,
2. Disposal of feces and urine,
3. Safe water,
4. Burial of bodies and carcasses,
5. A reasonable amount of rest.

Food is supplied by wheeled kitchens, a great boon to soldiers. Hot liquids are a tremendous stimulus to exhausted soldiers and the measure of good done by our Red Cross, Salvation Army, Knights of Columbus, Y. M. C. A. and other patriotic societies to soldiers going up to and returning from the battlefield has left a grateful memory in the soldier.

Pioneer battalions are absolutely necessary in these modern wars. They should follow the troops, bury animals, bodies, etc., burn refuse

or bury it, dig latrines and are at times indispensable in many ways. Unburied bodies and carcasses rapidly breed myriads of flies, streams polluted by dead are contaminated with their intestinal bacteria, the thirsty and tired men drink the water on the line, sicken and their germs of disease raised by passage to high virulence, and teeming in uncovered feces, are carried back by these flies to spread like a wave of cloud gas over the food of advancing reinforcements.

Latrines are mere straddle trenches a foot wide and a foot deep. They must be scrupulously covered by some one.

The question of safe water is settled by chlorinization. If the Lyster bag cannot be used, an ingenious American device is the dosing of the contents of some sergeant's canteen with a full tube of the powder, a plan suggested by Zinnser. The men can be advised that all they have to do to get safe water from the battlefield is to fill their canteens from any possible, unpoisoned source and put "a little," about a teaspoonful, from the sergeant's canteen into their own. In about 20 minutes they can drink reasonably safe water. No one will ever know the thousands of American lives saved by the bag devised by Colonel Lyster, of our medical corps, in the Great War. Vaccination against typhoid is not everything.

THE BACK AREA IN TRENCH WARFARE (POSITION WARFARE).

This is itself a subject for another paper. Only essential sanitary arrangements necessary to complement trench life will be mentioned.

Bathing and Delousing.

This should be at least under the supervision of the medical department for it is a powerful weapon against disease, as has been seen.

All men returning from a tour of duty in the trenches are put through the bath and delouser. The underlying principle of importance is *not* the bath; it is the killing of vermin and itch mites on clothing by heat. There should be two per division with an output of one thousand a day. There should be a medical department floor-walker to detect all skin diseases.

Types of Delousers.

The Fodden-Thresh single-cylinder and double-cylinder steam sterilizer for disinfection under pressure.

The French Autoclave of like type.

The Jacobs hot-air chamber and Orr Canadian hot-air chamber.

Types of Bathing and Delousing Establishments. French Army.

This is known as the personal hygiene section and it is run by the French medical department. Upon its general principles our American baths were run.

Personnel: One non-commissioned officer, a sergeant, two corporals, three mechanics, one barber and 10 men.

Bathers were admitted in groups of 40. It is a test unit. It consists of one store tent, Bessonneau, for clean clothing, one tortoise tent for storing soiled clothing, one tortoise tent for barber and chiropodist, one tortoise tent for valuables, and the bathhouse. The men on first entering the bath place their valuable in an individual bag bearing their bathing number. This bag goes into a basket which is locked and placed in the tortoise tent until they return from the bath. They now receive their bath number on a wooden tag, go to Room A of the bath house and look for their bath number painted on latticed seats in the center of the room. Here they undress, throw their underclothes on the floor, and stuff their outer clothing and shirt into a mesh bag with a tag bearing their number. This goes into the sterilizer. They keep their hats, their gas masks and their shoes to carry into the bath room. In the bath room these are placed in a cubby hole numbered with their bathing number.

Upon entering the undressing room, an attendant notes the size of the man for replacement of underclothing. There are only three sizes; one for short, one for medium and one for tall men.

A reserve of 10,000 suits of clothing is kept in the store tent and includes the following: Shirts, drawers, undershirts, stockings, towels, and handkerchiefs.

Each disinfector holds 40 kits, each composed as follows: Breeches, blouse, overcoat and pair puttees. The autoclave is a very handsome one and it has a steam ejector for creating a vacuum and drying coils for driving off steam after sterilization.

There is a hot-water tank on top of the autoclave which feeds the showers and gives a pressure up to one kilo by manometer. There are twenty shower heads. Water is heated to 38° C. and kept at that temperature by a cold-water mixer. A bell rings when 45° is reached.

The autoclave is drawn by two horses and the weight is 2,000 kilos (4,000 pounds). To set up this portable bather and delouser it is necessary to be near a watercourse giving at least one liter per second, and to have space up to at least 5,000 square meters. It takes two hours to set it up and eight hours to make ready for the first bath.

These baths require about 12 liters of water per man. Men are allowed, normally, ten minutes for actual bathing and it requires a minimum of twenty minutes to hand them their deloused outer clothing. Soap and towels are furnished by the bathing establishment and the dirty, but deloused, underclothing is stored in a tortoise tent to be trucked to the laundry after bathing hours if distant, an equal amount being returned clean from their store in exchange.

The English variation from this bathing establishment lay, as a rule, in the delouser itself. Toward the end of trench warfare disinsectization was accomplished by dry hot-air chambers. The most elaborate type of these is the Jacobs and the easiest to construct and run is the Canadian Orr which will be described. It can be built in a few days by four pioneers. It is essentially a hot-air chamber with double iron walls and the space between insulated by earth. It is heated by under-burning coke braziers and ventilated by holes into which fit wooden plugs, removable, to regulate the temperature. The loaded chamber attains 65° C. in ten minutes.

We were experimenting at Langres on a combination of bathing house, incinerator and laundry all in one, when the war came to a close.

Portable Hot-Air Disinfestor.

The Pleasants hot-air disinfestor and portable shower for companies or battalions. Mounted on Army general service wagon; has a limited application for service nearer the front.

The Serbian barrel will not be detailed as it is far from satisfactory and when used is a makeshift. The same principle on

wheels, devised by the French with a portable bath was however a most ingenious application.

Men should be bathed at least once every ten days and deloused at least once a month. Hence battalion organizations were each furnished, in our Army, with a Charles Le Blanc heater and 8 head showers, in addition to divisional baths.

Every rest area should have its cobbler shops, its tailor shops, and its barbers. They are, as are baths and delousers, run by Class B men, generally. Dirty, ragged men lose respect for themselves. "Smartness" has a determining influence on the soldier *at the front*.

Billets.—Neatness and cleanliness are the keys to their successful employment. Our men did wonders in tidying up stables, barns and outhouses in France. Scabies in a billet required "delousing" of all blankets and a working quarantine, if feasible, of occupants. The English greatly feared scabies and an English chief surgeon insisted that much of it was spread on latrine seats.

Kitchens.

Time does not permit their discussion, which offers much of interest. The main desiderata are:

1. Cleanliness and simplicity of equipment. A clean kitchen inspires a good appetite. Everything that shows should be immaculate and always in its place. Men should be allowed to help themselves from a common receptacle and be told to never take more than they want, but always come back for more if they were still hungry. The English said that they saved 10,000 pounds in that way in a year at one large camp.

2. All grease should be salvaged and sullage water deprived of its grease by traps. The water then percolated into the earth without clogging its pores after being led into a filtering cess-pool or "soakage pit."

3. All scraps of food, especially bread and meat, were saved and made into tasty dishes at subsequent meals. This means not only the teaching of cooking to cooks, but of "catering" to mess sergeants. A full garbage pail became a poor recommendation for any unit in the A. E. F.

4. A brick or cement floor was most desirable in a kitchen and whitewash and tar liberally applied at least helped as an appetizer.

5. Cooks should be *compelled* to wear white caps and aprons in the rest area. Dirty cooks mean dirty food—and generally a “full garbage pail.”

6. Menus should be varied and stews should not figure on more than 3 days in the week. Meat should be stored in meat safes and “quarters” should be hung, haunch down, and covered with burlap or muslin bags.

We labored with the generally acknowledged defect that the culinary art in the United States had declined. “Canned stuff” was offered as the solution, but with all its virtues it can never replace art. Besides it is at least debatable whether a preponderance of canned foods is more desirable than a fair representation of the dishes “that mother used to turn out.” But the great, the crying, sin was the capacity for enormous waste of food material, “not equalled by any country on earth,” an Americanism we carried with us to Europe. Our Army manfully struggled with this generous failing and certainly improved the situation, but it was only by persistence that real saving was accomplished.

Latrines.

The ideal latrine for troops under ordinary conditions was the deep pit and flyproof box seat. Even the English acknowledged this, but it should be from 10 to 12 feet deep. The seats should be cleaned inside and outside daily and blackening of the pit with lamp black and crude oil is desirable. The trouble was we could not get crude oil. Burning out of pits was also impossible; there was no mineral oil “to waste.” Hence the American Army devised their own latrine, a cross between the American and a French commodity. It was simply a deep pit rimmed at the surface by two-by-fours with a platform covering it in. Every two boards were nailed down. The intermediate one was loose and could be removed by a handle or a pole fixed perpendicularly in the center. Thus there was no seat, the simple concession of the French to economy. It was flyproof when the loose boards were replaced. The British, on the other hand, provided what was for most cantonments, in France, the

most feasible and certainly the most sanitary arrangement; the bucket latrine and incinerator. Pits could not be dug in many places ten feet deep without striking water or rock. Besides, the French bitterly opposed, and with reason, the digging of pits for feces. The incinerators built by the British usually served 800 men and were models of practical common sense and good sanitation. They usually presented a hopper leading down onto a hot plate for drying of excreta before dumping the contents upon the fire and this served for solid garbage as well. Often a few coils of pipe were led around the fire box and heated water for an ablution bench nearby. Everything about the incinerator could be built with stones, old bricks, a little cement, old rails, old bits of iron sheeting, etc., and in an incredibly short time. The fuel was ostensibly at the rate of 100 pounds a day. In reality 2 pounds of coke was used to start the fire and the thing was kept at full blast eternally, like the altar fires of the Vestal Virgins, by camp trash. This kept the camp clean because the incinerator was served, as were these altar fires, day and night, by a husky soldier looking for a fuel economy record; the camp was carefully gleaned daily and gleanings deposited by that incinerator. The latrine was nearby, a long shack with usually a cement floor, flyproof seats and, under each seat, a bucket. In front of the seats was a urinal, a metal water way leading down into a soakage pit. A little cresol stood in each bucket and before incinerating the contents a good 20 per cent. of saw dust was added to insure incineration. The buckets were emptied twice a day and smeared with crude oil, which they secured in some manner, before replacing. I never detected the odor of feces in any British camp I visited. Critical eyes may challenge this statement, but no one will testify that the bucket latrine was a failure if they saw enough of them. The English became so bold that they would place their bucket latrines near their kitchens and mess halls. This, with the proximity to ablution benches, where hot water was obtainable for the morning shave, very much simplified daily routine and stimulated cleanliness and an orderly observation of sanitary principles. The answer of the British to an objecting theorist would invariably be:

"If you have clean latrines and burn your feces you need not fear flies."

In concluding this long paper we are compelled to the reflection that, after all, the great point is that it was not only mechanical sanitary appliances that we were after but the sensitizing of our soldier's conscience by appealing to his sense of decency. The immediate commander of troops must inculcate in his men, in addition to a strict regard for military discipline, a decent regard for the ornate, and as a result thereof, for the clean and neat. It should be deliberately taught men that it is not enough to have merely the "rough stuff," the bare necessities; that civilized men are expected to improve their natural condition; that they should keep themselves and their surroundings clean if they expect to keep well; that they should keep their initiative, their ambition, their imagination active; that to make their barracks, their reading rooms, their camps clean and attractive to the eye is to preserve those illusions of life which are necessary to make men contented and happy.

Nothing illustrates this spirit better than the following incident: When the First Division was in a training area under the tutelage of the famous and gallant 47th Division of Chasseurs, the disposal of manure piles in the center of these tiny hamlets was a sore trial to us American officers. The French had some towns for billeting and we had others. One day in traveling over the French area with Colonel Cultin, their division surgeon, I noticed that none of his towns possessed the protruding manure pile beside the neat little house in the main street. On inquiring how it was that no amount of coaxing or threatening by French civil authorities had prevented their reappearance in our towns, he replied: "We removed the piles to the site the owner selected himself out of town, and planted flowers where they used to be—and no good French peasant will smother growing flowers with manure piles."

Nor will an American soldier spit on a clean floor, nor befoul a neat home, which he has been led to beautify by his own efforts.

It may seem trite to mention that neither laws in a civil community nor regulations in the Army are alone potent to sanitize one or the other. There is a difference between securing the precision of a machine in a military organization and considering a

man simply as a machine. Germany had the most perfect machine in the world and she failed. She persistently bid us to treat our men as machines and she herself failed. It is the spirit of a glorious France that bespeaks our own American heart and the words are from the favorite work of a brave and humane officer, idolized by his men, Major General Goubeau, given me personally as his division watched the road to Metz:

“Le soldat n'est point une machine. Avant d'être une unité de groupe, il est une personne.”

SURGEON-GENERAL'S OFFICE,

WAR DEPARTMENT, WASHINGTON, D. C.

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